Subject: Corrected MSD Colloquium, Hellwig, Thurs, 9/06, 11am, 212, A-157
From: Suzanne Kokosz <kokosz@anl.gov>
Date: Mon, 23 Jul 2007 15:30:47 -0500
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MATERIALS SCIENCE COLLOQUIUM

SPEAKER: DR. OLAV HELLWIG
Hitachi Global Storage Technologies, San Jose

TITLE: [3]The Physics of Perpendicular Anisotropy Layered Antiferromagnets[2]

DATE: Thursday, September 06, 2007
TIME: 11:00 a.m.
PLACE: Building 212, Room A-157

HOST: Axel Hoffmann

Refreshments will be available at 10:45 a.m.

Abstract:
Magnetic storage technologies exploit antiferromagnetic (AF) exchange coupling in state of the art media and head designs [1]. While historically devices had the magnetization of the layers within the film plane, nowadays a magnetization perpendicular to the plane is preferred. This is certainly the case for recording media and may apply to other devices as well. Motivated by this, we explored the magnetic properties of a model system for layered antiferromagnets with perpendicular anisotropy ({[Co/Pt]X-1 Co/Ru}N [Co/Pt]X multilayers) [2-4]. In this model system we can balance the different energy contributions of anisotropy, dipolar interactions and AF interlayer exchange in various ways. For dominating interlayer exchange (EAF exchange > EAnisotropy), spins are able to tilt away from the perpendicular anisotropy direction and we observe a reversal via a laterally uniform spinflop transitions. In contrast for dominating anisotropy (EAnisotropy > EAF exchange) only spin up and spin down states with respect to the layering are allowed, thus resulting in a laterally heterogeneous reversal via domain formation [2-4]. Here we observe a laterally uniform AF remanent state if the AF interlayer exchange remains stronger than the dipolar interactions (EAF exchange > EDipole). However, if the dipolar interactions overcome the AF interlayer exchange (EDipole > EAF exchange), then the formation of an AF state is suppressed and we observe ferromagnetic stripe domains at remanence. In contrast to in-plane systems dipolar fields and the interlayer exchange coupling compete with each other, thus resulting in novel phase transitions and surprisingly complex and rich domain structures that have not been seen for in-plane systems. Imaging studies of such novel domain structures [4-8] will be presented with corresponding energy calculations that explain our observations. Finally I will motivate that our magnetic model systemmay be used to gain insight into other more general systems with similar energy landscape that reach far beyond the world of magnetism alone [4].

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[4] O. Hellwig, J. B. Kortright, A. Berger and E. E. Fullerton, J. Magn. Magn. Mater, in print, online published as doi:10.1016/j.jmmm.2007.04.035 (2007).
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[7] A. Baruth, L. Yuan, J. D. Burton, K. Janicka, E. Y. Tsymbal, S. H. Liou and S. Adenwalla, Appl. Phys. Lett. 89 (2006) 202505.
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